

What is claimed is:

1. A computer-implemented system for managing a collection of mutually dependent information contents networked over the Web, comprising:

a collection of Web documents, referred to as a content net, that comes with computer-executable representations of dependency relationships among elements of those documents; and

means for automatically propagating updates introduced in elements of said Web documents to all elements of said Web documents that depend on those updated elements.

2. The computer-implemented system according to claim 1, wherein said content net comprises a collection of content files, *i.e.*, Web documents representing information contents, and a separate collection of constraint files, which represent dependency relationships among elements of content files.

3. The computer-implemented system according to claim 2, wherein said content net is a collection of pairs of a content file and a constraint file, which represents dependency relationships of elements in the associated content file on elements in any content file of the content net.

4. The computer-implemented system according to claim

1, 2 or 3, wherein the representation of said dependency relationships comprises:

unique identifiers for active elements, *i.e.*, elements involved in dependency relationships, where the uniqueness is ensured by values of a designated attribute, called content variables, uniquely assigned to those active elements, or by an equivalent means; and

dependency expressions written in Web-standard languages such as XML (Extensible Markup Language) and MathML (Mathematical Markup Language), using element identifiers such as content variables.

5. The computer-implemented system according to claim 4, wherein said dependency expressions follow the format of dependency clauses or a format equivalent to dependency clauses, and are represented in constraint files or embedded in information contents of Web documents in the content net, where a dependency clause comprises three terms, the first term representing a content variable, the second term a set of content variables, and the third term a definition of a dependency relationship between the content variable in the first term and the content variables in the second term.

6. The computer-implemented system according to claim 5, wherein said dependency clauses are:

functional dependency clauses, which have no

tree-structure, hierarchical relationships between the element corresponding to the content variable in the first term and the elements corresponding to the content variables in the second term; or

hierarchical dependency clauses, in which the elements corresponding to the content variables of the second term are hierarchically related to the element corresponding to the content variable of the first term.

7. The computer-implemented system according to claim 6, wherein said third term in said functional dependency clause is a functional expression involving operators of MathML, operators that can be referenced in MathML, and content variables in the second term in the clause.

8. The computer-implemented system according to any claim from claim 1 through claim 7, further comprising a dependency structure analysis module, which:

given a set of updated active elements, identifies its update candidate set, which contains all active elements, or corresponding content variables, which depend on some active elements in the given set;

determines the presence or absence of cyclic dependencies among active elements in Web documents in the content net.

9. The computer-implemented system according to claim 8, further comprising a module which, given an update

candidate set, recursively updates elements in the update candidate set.

10. The computer-implemented system according to claim 8, further comprising:

an update ranking module which, given an update candidate set, computes update orders, or ranks, for elements, or corresponding content variables, in the update candidate set; and

a module which updates elements in a given update candidate set, following ranks determined by the update ranking module.

11. The computer-implemented system according to claim 9 or 10, further comprising:

a station, namely a browser-based presentation of a Web document representing information contents in a content net, as a collection of ports for information interchange, or a port complex, over the Web; and

a station net, namely a collection of stations networked over the Web and accessible to human users in the Web environment, where each station in the collection is derived from a Web document representing information contents in a designated content net.

12. The computer-implemented system according to claim 11, wherein said station comprises:

internal reference ports for receiving information from

sources within the station net containing this station;

external reference ports for receiving information from applications such as database applications outside the station net;

initial ports for sending information to other ports within the station net containing this station; and
a local port for keeping information within the station for local use.

13. The computer-implemented system according to claim 12, wherein said ports in said station are equipped with:

control functions for update propagation within the entire station net;

control functions for importing information from external applications such as database applications;

control functions for exporting information to external applications; or

control functions obtained by sequential or concurrent compositions of said control functions above.

14. The computer-implemented system according to claim 13, wherein said control functions can operate in:

operator control mode in which said control functions are initiated by human users; or

program control mode in which said control functions are initiated by computer programs.

15. The computer-implemented system according to claim 12, 13 or 14, wherein content variables, or corresponding elements, of a content file map to ports of the station corresponding to the content file respecting the following constraints:

an internal reference port is associated with a set of content variables which depend on other content variables via functional dependency clauses;

an initial port is associated with a set of free variables;

an external reference port is associated with a single free variable; and

a local port is associated with the set of all non-active elements which are not sub-elements of an active element.

16. The computer-implemented system according to claim 15, wherein for each station, its layout is specified in a Web-standard language such as XSL (Extensible Style Language) separately from the content file of the station.